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ABSTRACT

It is suggested that because of the tendency of psychologists to characterize behavioral phenomena in distinctive ways, it is frequently difficult to determine if the same label is being used to refer to the same phenomenon by different investigators. One strategy to overcome this problem is to determine if similar conclusions are reached when the same dependent variable is manipulated by various investigators operating under different paradigms. This strategy is applied to the construct of verbal mediation. Three different paradigms are presented. Two major findings tend to recur: (1) overt verbal behavior appears to be correlated with various types of problem-solving behavior which continues to occur even after the verbal behavior has become internalized; and (2) there exists a period when, although the appropriate verbal responses are in the individual's repertoire, they do not serve a mediating function. It is suggested that the theorist-researchers reviewed are dealing with basically the same phenomenon. Several generalizations concerning the development of the verbal mediatien process are abstracted, and several implications for the area of education are discussed. (Author)

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THEORETICAL PAPER NO. 21

THE EARLY DEVELOPMENT OF VERBAL MEDIATION IN CHILDREN: AN INTER-PARADIGM COMPARISON

REPORT FROM THE MOTIVATED LEARNING PROJECT

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WISCONSIN RESEARCH AND DEVELOPMENT

CENTER FOR COGNITIVE LEARNING

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THE EARLY DEVELOPMENT OF VERBAL MEDIATION IN CHILDREN: AN INTER-PARADIGM COMPARISON

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Report from the Motivated Learning Project
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Wisconsin Research and Development
Center for Cognitive Learning
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Madison, Wisconsin

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Activities are differentiated into three research and development Programs —1, Conditions and Processes of Learning; 2, Processes and Programs of Instruction; and 3, Facilitative Environments—and support programs. This Theoretical Paper is from Project Motivated Learning in Program 1. General objectives of the Program are to generate new knowledge about concept learning and cognitive skills, to synthesize existing knowedge, and to develop educational materials suggested by the prior activities. Contributing to these Program objectives, this project aims at extending and learning theory in the context of complex human behavior, and applying the theory in developing procedures to solve problems of human learning.

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ABSTRACT

It is suggested that because of the tendency of psychologists to characterize behavioral phenomena in distinctive ways, it is frequently difficult to determine if the same label is being used to refer to the same phenomenon by different investigators. One strategy to overcome this problem is to determine if similar conclusions are reached when the same dependent variable is manipulated by various investigators operating under different paradigms. This strategy is applied to the construct of verbal mediation. Specifically, a review of theory and research concerning verbal mediation as a function of age is presented, based upon three different paradigms, the Russian position, the Cognitive position, and the S-R position. This review is limited to the development of mediational processes up to the point where they have either become internalized or their operation is complete, and is limited to selected theorist-researchers operating under each paradigm.

Two major findings tend to recur regardless of the paradigm generating the research: 1) overt verbal behavior appears to be correlated with various types of problem-solving behavior which continues to occur even after the verbal behavior has become internalized; and 2) there exists a period when, although the appropriate verbal responses are in the individual's repertoire, they do not serve a mediating function. Thus it is suggested that the theorist-researchers reviewed are indeed dealing with basically the same phenomenon. Based upon this conclusion, several generalizations concerning the development of the verbal mediation process are abstracted, and several implications for the area of education are discussed.

I
INTRODUCTION

The fact that psychologists work under different paradigms, i.e., conceptions of law, theory, and methodology which are shared by various groups within the scientific community (Kuhn, 1962), sometimes results in several problems which make it difficult to compare theory and research in order to integrate conclusions concerning behavioral phenomena. One such problem concerns the tendency of different paradigms to attach distinctive labels to the constructs and related phenomena under study. For example, the label "frustration" is frequently applied to the process of blocking a goal-oriented response, while the term "extinction" is applied by S-R psychologists to the process of withholding a reinforcer previously contingent upon some specific response. A simple translation of terms suggests that "frustration" and "extinction" may well refer to the same process.

A second major problem exists when the same label is used in different paradigms to refer to different constructs and phenomena. For example, "word meaning" is defined by some psychologists as a portion of the total response made to the object to which the word refers (Osgood, 1953), while others define meaning in terms of the total number of word associates elicited by the word (Noble, 1952). Even experimental demonstrations that these two constructs are independent (e.g., Staats, Staats, Finley, and Minke, 1963) tend to be ignored. This is probably a function of the fact that investigators are usually aware only of research conducted within their own paradigm.

Staats (1968a, 1968b) has recently made a similar analysis of the tendency of psychologists to categorize behavioral phenomena in distinctive ways.

> First, the categorization approach leads one to treat as different behaviors that are actually the same.... [U]se of one label ordinarily restricts interest in the study to investigators working within that particular category. Studies done under one label are not related to those done under another.
>
> In addition, many times behaviors are discussed as though they were the same, although different learning principles are involved in each case ....Categorization schemes that suggest a unitary process narrow the scope of our considerations. For this reason it is necessary to promulgate a 'pluralistic' approach to many areas of human behavior (1968b, p. 573).

It is suggested that one way of overcoming these semantic problems is to see if similar conclusions are reached when the constructs are used as dependent variables with the same independent variables, or as independent variables while the same dependent variables are manipulated. The first strategy, for example, adds support to the possibility that "frustration" and "extinction," while defined differently, are indeed the same process. Both "frustration" and "extinction" can, under the appropriate conditions, produce aggression, persistence, apathy, compensation, etc. Thus, the effects of the two processes are the same.

In this paper the second strategy is employed with respect to the concept of "verbal mediation." A review of theory and research concerning verbal mediation as a function of age is presented, based upon three different paradigms. Because of the scope of this topic, this paper has been limited to the development of mediational processes only up to the point where they have either become internalized or their operation is complete. Further, no attempt has been made to completely cover the field. Except in the case of the Russian work, one theorist-researcher has been selected to represent each of the three major theoretical and empirical approaches discussed.

After a brief discussion of the need for a concept of verbal mediation, an attempt will be made to summarize three major theoretical approaches concerning the early development of verbal mediating mechanisms in children, i.e., the Russian approach on the basis of the Second Signal System, as exemplified by Luria and Vygotsky; the cognitive approach, as exemplified by Bruner; and the S-R approach, as represented by the Kendlers, and some of the relevant experimental data will be presented. Because of the similarity of the research findings generated under these paradigms, it will be suggested that despite widely different theoretical models, the term "verbal mediation" is being applied to basically the same process. On this basis, an attempt will be made to synthesize the views of these three approaches and to determine if the common findings have significance in terms of educational practices and procedures.

II

THE FUNCTION OF A CONCEPT OF VERBAL MEDIATION

Goss (1961) defines a mediator as follows: "When events A, B, and C occur in the sequence A → B → C and A → C, and the probability of the occurrence of C is actually or potentially greater or less when C is preceded by A → B than when C is preceded by A alone, B can be described as a mediating process or event" (p. 286). Such a definition appears broad enough to encompass most, if not all, the conceptions of the role of verbal behavior to be presented in this paper. Difficulties seem to arise, however, when one attempts to be more specific concerning the nature of the B term in the above definition.

These problems arise because of the usually implicit nature of the mediator—not being directly observable, the mediating response must be inferred from observation of responses and stimulus situations. Goss discusses six conditions under which verbal mediation is evoked as a post factum explanation or is assumed to have taken place: 1) when latencies of response occur which are longer than those known or considered to be sufficient for Ss to make the response; 2) when certain forms of activity are observed during the period between the presentation of the stimulus material and the measured response, e.g., movement of lips, counting of fingers, etc.; 3) when Ss make retrospective reports of "thinking" or other mediational activity; 4) when the relationships between stimuli and responses are modified by means of various sorts of instructions; 5) when overt mediation has been observed in the same or similar Ss in the past; and 6) when explanatory dilemmas occur. Most of these methods will be demonstrated in the experimental work to follow.

It should be noted that the last condition suggested by Goss, the existence of explanatory dilemmas, served as the major impetus for the development of mediation theory in the first place (along with the philosophical concept of consciousness), and at the same time serves as the major evidence for the existence of such mechanisms. Mowrer (1960) points out three major categories of phenomena which have been important in the development of mediation theory in the S-R tradition, particularly verbal mediation theory. First, he points to the general phenomenon of "mediated generalization," the ability of individuals to respond to two or more physically dissimilar stimuli following training with only one of these stimuli. Second, he points to the related phenomenon of "acquired distinctiveness of cues," the ability of individuals to respond differently to two or more initially quite similar stimuli. Finally, he indicates the use of mediation theory to account for the various "latent learning" phenomena, where responses are separated in time from their controlling stimuli.

Bruner (1966b), representing a more cognitive approach to the problem of verbal mediation, lists six "benchmarks" against which a theory of intellectual growth can be measured, in that the theory must be able to handle these phenomena: "1) Growth is characterized by increasing independence of response from the immediate nature of the stimulus. 2) Growth depends upon internalizing events into a 'storage system' that corresponds to the environment. 3) Intellectual growth involves an increased capacity to say to oneself and others, by means of words, what one has done or what one will do. 4) Intellectual development depends upon a systematic and contingent interaction between a tutor and a learner. 5) Teaching is vastly facilitated by the medium of language, which ends by being not only the medium for exchange but the instrument that the learner can then use himself in bringing order into the environment. 6) Intellectual development is marked by increasing capacity to deal with several alternatives simultaneously, to tend to several sequences during the same period of time, and to allocate time and attention in a manner appropriate to these multiple

demands" (pp. 5-6). Bruner considers a form of verbal mediation to be partly responsible for these phenomena.

It would seem that neither Bruner nor Mowrer would disagree with each other as to the phenomena upon which a concept of verbal mediation is based. Although Bruner lists more of such phenomena than Mowrer, Mowrer's three categories are all subsumed under Bruner's points, and the differences between the two appear to be mainly semantic.

III
THEORY AND RESEARCH

THE RUSSIAN POSITION

The concept of a Second Signalling System is central to Russian psychology's approach to the study of the role of language in the development of the child. Razran (1961) draws the distinction between the First and the Second Signalling System by indicating that the First Signal System is what Pavlov was studying in the dog and consists of the simple conditioning of overt responses. In the First Signal System initially neutral stimuli are made signals for events which usually have biological significance for the animal. For example, through conditioning procedures a light can come to be a signal for the consequent presentation of food. The Second Signal System, however, involves higher-order conditioning in which a stimulus becomes a signal of many signals. It is this system which is involved in verbal behavior. 'Berlyne (1963) points out that this mechanism allows the word-bearing child to select the common features of an array of stimuli and ignore the irrelevant, and to draw generalizations based upon this abstraction. In other words, the array of stimuli serves as a CS for some sort of verbal behavior dealing with the similarities and differences among the stimuli, which in turn serves as a CS for further verbal behavior and/or appropriate motor behavior, which can then result in new learning.

The Second Signal System also exhibits properties not found in the First Signal System. Responses are maintained without continuous reinforcement, i.e., without continuous pairings with a UCS, and are quite resistant to extinction. However, the Second Signal System is also quite flexible in that under the appropriate conditions, the meaning of an association can be discarded or changed readily. Apparently this flexibility is a function of inhibitory mechanisms. Finally, new forms of basic behavioral processes are manifested through this system, e.g., semantic generalization.

The two investigators to be discussed in this section, Luria and Vygotsky, are both concerned with the development of the Second Signal System. Luria, however, is more concerned with the development of control over motor behavior by verbal behavior, while Vygotsky, called the "Father of the Second Signal System," even though the concept was initially introduced by Pavlov, is more concerned with the distinction between overt and inner speech. There are also minor differences between the two men with respect to their conceptions of the nature of the symbolic responses involved in the Second Signal System: Luria seems to hold with an associationistic view while Vygotsky has taken an anti-associationist position. Finally, there appears to be a distinction between the two with respect to their influence upon American psychology. Luria seems to be more influential with the S-R position, while Vygotsky appeals more to the cognitively oriented psychologists.

Luria (1957, 1959) has postulated four stages in the regulation of motor behavior by verbal behavior on the basis of a series of experiments by himself and his colleagues involving children of different ages.

Orienting Response Stage (0-2 years). —Luria found no discernible sign of any form of verbal mediational behavior in the children up to the age of 2 years. In this stage words spoken by other individuals gradually acquire the property to control the behavior of the child, but only the First Signal System appears to be involved. A verbal command to a child over 1 year will evoke the appropriate orienting or motor response, but only so long as there is no conflict either in terms of stimuli controlling competing orienting reactions or in terms of conflicting ongoing behavior. In some cases changes in verbal instructions not only do not result in an appropriate change in behavior, but result in an increase in vigor of the ongoing

behavior. Luria states that adult speech during this phase basically serves a release function: it can neither suppress an ongoing act nor deflect a child from one act to another. At this stage the release function of speech is developed somewhat adequately, but the inhibitory function of speech is not.

The absence of verbal mediation on the part of children up to the age of 2 years was demonstrated in an experiment in which a coin was hidden under either a cup or an opaque glass and the child was asked to find it. If the coin was placed under the appropriate container within the sight of the 2-year-old child, he could locate it when told to do so both immediately and after a 10-second delay. When the coin was hidden unseen by the child and he was told "The coin is under the cup...find the coin," he could again locate it without difficulty. However, when the instructions to "find the coin" were delayed by 10 seconds, Ss experienced difficulty with the problem, particularly if the coin were switched to the other container. In other words, the children could not make use of verbal behavior to effectively bridge the time gap.

Impulsive Stage (3-4 years). —This stage is distinguished by the ability of self-produced speech to regulate behavior to a certain extent. However, the First Signal System is still operative, so that speech must still operate on a one-to-one basis with the behavior. Further, the inhibitory function of speech is still lacking.

The remainder of Luria's experiments to be discussed all involve the use of a piece of apparatus consisting of a set of lights and a rubber bulb; S's task in each case is to squeeze the bulb. The frequency, pressure, and temporal coordination of the squeeze with the stimulus are recorded on a kymograph.

In one set of experiments, children up to 4 years of age were initially told that when the red light came on they were to press the bulb, but when the blue light came on they were not to press. After having Ss repeat the instructions, the experiment was begun. After a few trials Ss would squeeze the bulb under both light conditions; Ss would often try to convince E that the instructions were to press the bulb to both lights. Appropriate control could only be gained over Ss' performance by E supplying instruction on each trial, i.e., he would say "Press!" or "Don't press!" after each presentation of a light.

The next step in this series of experiments was to set up a mediation condition whereby Ss were instructed to supply their own verbal stimulation contingent upon a light presentation, thus replacing E's verbal instructions with instructions produced by S himself. It was found that the verbal responses would occur appropriately (i.e., Ss would respond "Press!" each time the red light came on and "Don't press!" each time the blue light came on), but the motor response was not controlled by these verbalizations. Ss would squeeze appropriately following the presentation of the red light, but would squeeze even harder when the blue light was presented.

In another experiment Ss were initially instructed to press the bulb twice when the red light came on. Even though it was apparent that Ss knew the meaning of the word "twice," this behavior could not be obtained until they were instructed to say "Go,go!" each time the light was presented. The child's verbal behavior does not seem to play a distinctive role in this situation; it would be expected that instructions to tap one's finger twice contingent upon a light flash would have been just as effective. In other words, the First Signal System is still operative.

Selective Stage (5-9 years). —In the selective stage S still finds complex conditional discrimination troublesome, i.e., he still has difficulty responding appropriately on the basis of initial instructions of the form "when this happens, do this," unless he is given verbal prompting or he overtly rehearses the instructions throughout the experiment. However, his own speech can now inhibit his behavior and he can respond correctly to his own instruction, "I shall press twice." The child's verbalizations during this stage begin to undergo internalization, and much of the verbal behavior is carried on in a whisper. It is during this stage that the Second Signal System first begins to operate.

Unfortunately, as the Second Signal System develops, Luria provides meager data and little more than general statements concerning the relationship between language and behavior. Therefore, these last two stages can be characterized only by summary statements.

Preselection Stage (9 years and older). —This represents the final stage in the development of verbal control over behavior. Verbal mediation now occurs through internal speech, and all of the properties of the Second Signal System are operative. Ss can now make a verbal analysis of a situation and thereby establish new connections (i.e., they can "learn through reasoning").

It is important to point out that internal speech according to Luria is not just implicit vocalization. Rather, it consists of semantic units which are related to words and to each

other in an associative manner. These units and their association with environmental stimuli, with each other, and with the appropriate overt behaviors are acquired through a gradual process upon overt verbalizations on the part of the child.

Luria's conceptions concerning the nature of internal speech are based upon those of Vygotsky (1962)[1]. Vygotsky argued, on the basis of both phylogenic and ontogenic evidence, that language and thought are not the same thing, even though they interact and influence one another intimately. He held that the appropriate unit of analysis for verbal thought is word meaning, where words refer not to single objects but to groups or classes of objects. Word meaning is regarded as somewhat similar to sensation; the qualitative distinction between sensation and thought is this generalized reflection of reality contained in the meaning of a word. This approach, he felt, avoids the pitfalls of both the "reflexologists," or American Behaviorists, who held that thought and speech were the same thing, and the dualism of the Wurtzburg School, which theorized that thought and speech were two independent, distinct processes connected in a mechanical manner.

Vygotsky considered the development of inner speech to proceed as follows: initially, the child's verbal behavior is essentially social. At a certain age, however, the child's speech becomes differentiated into what Piaget refers to as egocentric and socialized speech. Socialized speech refers to speech involving an exchange with others, while egocentric speech refers to speech engaged in by the child as an accompaniment to activity. It serves no communicative function and concerns the child himself rather than other people. While at that time Piaget regarded egocentric speech as providing no realistically useful function and dying out as the child nears school age, Vygotsky held that egocentric speech is a transitional stage in the evolution from vocal to inner speech, and that it represents an instrument of thought, in that it is involved in seeking and planning solutions to problems.

This conception of egocentric speech serving verbal mediating functions grew out of observations of children engaged in play and problem situations. Vygotsky found that in problem situations the relative frequency of egocentric talk nearly doubled. For example, in a situation in which E removed a blue pencil prior to the commencement of a drawing activity by a child, the youngster was later overheard talking to himself: "Where's the pencil? I need a blue pencil. Never mind, I'll draw with the red one and wet it with water; it will become dark and look like blue" (p. 16). To Vygotsky this was clear evidence that egocentric speech was serving a thinking function.

On the basis of this analysis, Vygotsky then proceeded to observe egocentric speech in order to draw inferences concerning the nature of inner speech. On the basis of these observations he concluded that inner speech is distinct from overt speech in terms of function; the former is speech for oneself, while the latter is speech for others. Inner speech has a peculiar syntax—it tends to omit the subject of the sentence and its modifiers, while retaining the predicate. With syntax reduced to a minimum, and sound missing, meaning, per se, becomes the important element of this speech system.

THE COGNITIVE POSITION

Bruner (1964, 1966a) views verbal behavior as only one form of mediating mechanism, one which develops relatively late in the cognitive development of the child. He holds that there are three types of representations of the environment which can serve as mediators, freeing the response from the immediate perceptual field. These three modes of representation appear in the child in sequential order, each depending upon the previous one for its development, yet all of them remaining more or less operative throughout life.

The first form of representation is called enactive. This is a mode of representing the environment through appropriate motor responses, i.e., the child's world first becomes known to him principally by the habitual behavior he uses in interacting with it. Bruner uses as an example of enactive representation an observation of Piaget. A child, nearly a year old, is playing with a rattle in his crib when it falls from his hand to the floor. The child moves his clenched hand before his face and opens his fist looking for the rattle. Not finding it, he closes his fist and repeats the behavior leading to the loss of the rattle—i.e., shaking his hand. Again he lifts his hand to his face and again finds no rattle and repeats the sequence again. In other words, the behaviors

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[1]The date 1962 may be misleading to the reader; this is the copyright date of the English translation of Vygotsky's book. Actually, his work in psychology took place between 1924 and 1934.

appropriate to the rattle are a representation of the rattle itself.

The second form of representation to develop is iconic, and is dependent upon the use of images to represent the environment. The child can now reproduce things that have been present in his environment in the past, so long as this reproduction takes place in the same form as the previous experience. At this stage, when the child drops his rattle, he begins searching for it, instead of engaging in movements appropriate to the rattle, and this behavior is considered to be mediated by an autonomous image of the toy.

Of most importance to the topic of this paper is symbolic representation. This is representation in terms of words or language and involves encoding features of the environment into verbal behavior and then decoding the verbal behavior into any one of a number of possible overt behaviors. Symbolic representation basically frees the individual from the realities of the environment, since the rules for transformation of verbal behavior operate independently from any perceptual reality.

Bruner and his associates have conducted several experiments that bear upon the development of the symbolic mode of representation. In one study children between the ages of 5 and 7 were presented nine plastic glasses arranged in a 3 x 3 matrix on cardboard. There were three diameters represented, and for each diameter there existed three values of height. Initially the glasses were presented in systematic order, increasing in height across columns and decreasing in diameter across rows, from top to bottom. Then glasses were either selectively removed and the child had to replace them appropriately, or they were scrambled up and S was required to recreate the initial pattern. The results indicated no age differences in the ability to perform either of these tasks.

Finally, the glasses were again scrambled, but this time the glass that was formerly in the southwest corner was placed in the southeast corner, and S was asked to reproduce the original model without moving this glass. The solution to this transformational problem lies in now arranging the glass according to height across rows and according to diameter across columns. Performance on this task was found to be highly correlated with age. The older children would sit back and talk to themselves about the relationship between place and size whereas the younger Ss appeared to be dominated by the earlier model. Bruner concluded that the younger children were working through iconic representation, even though some verbalization was observed in them, while the older children were able to solve the problem through transformations involving symbolic representation of the situation.

Bruner hypothesized that during this transitional stage between iconic and symbolic representation, one of the reasons that symbolic representation does not operate in certain problems is that the iconic representation is so habitual that it prevents the more powerful symbolic representation from occurring. To test this notion, he presented the following task to children from 4-7 years of age. First he presented S with two equal beakers, filled with the same amount of water. The child said that there was the same amount of water in both. Then E poured the water in one of the beakers into a new beaker that was taller and thinner than the original. At this point virtually all the 4- and 5-year-olds and half of the 6- and 7-year-olds would say that there was more water in the new beaker. If the iconic representation indicated by this performance were preventing an already developed form of symbolic representation from occurring, then initially removing the visual cues, i.e., having S work the problem out "in his head" prior to being shown the beakers should result in improved performance. This was done by placing a screen in front of the beakers, leaving only their tops exposed to view, and then the water was poured into the new beaker which was now hidden. Half of the 4-year-olds and nearly all the remaining Ss said at this point that the amount of water in the new beaker was equal to the amount in the standard beaker. When the screen was then removed, only the 4-year-olds returned to the incorrect mode of responding; the remaining Ss continued to say that the amount of water in the two beakers was equal. On the basis of the verbal behavior emitted by Ss following the removal of the screen, Bruner concluded that language provided a means to break away from the perceptual cues in terms of making a judgment.

THE S-R POSITION

Goss (1961) points out that the S-R approach to verbal mediation had its beginnings with Watson, who equated thought with implicit, vocal speech. Watson not only provided a pure stimulus-response paradigm for higher thought processes, but he also presented a paradigm for the phenomenon that is today referred to as "response-mediated generalization."

Of some interest in terms of comparison with later S-R mediation theory and the mediational conceptions of other theorists discussed in this paper is Watson's conception of the nature of the mediating response. Watson (1924) stated,

"...what the psychologists have hitherto called thought is in short nothing but talking to ourselves" (p. 238). He then qualifies this by pointing out that he does not mean that thought is to be equated to laryngeal movement. Rather, he suggests that vocal behavior involves a whole complex of musculature and that in fact, through conditioning, any possible bodily movement can become a word substitute. Thus, Watson's position is much broader than Vygotsky's interpretation of it.

Kendler and Kendler (1962) are quite vague as to the nature of the mediating response in verbal behavior. They state that mediating events might be coordinated with language, muscle movements, introspective reports, and other observables, but that such coordination is not necessary. They suggest that defining a verbal mediator as an intervening variable having response-produced stimulus properties is sufficient for an analysis of verbal mediation.

The Kendlers regard their approach to verbal mediation as "pretheoretical," but on the basis of some of their research involving reversal and non-reversal shifts in a concept attainment task, T. Kendler (1964) has proposed a 3-stage model for the development of verbal mediation in children: 1) verbalization has little influence on behavior; 2) Ss can use instructions furnished by others to verbalize and then use this verbalization to mediate their performance; and 3) Ss can generate their own words for mediational purposes.

The basic experimental paradigm utilized by the Kendlers (T. Kendler, 1963) consists of the presentation of stimuli that differ simultaneously on at least two dimensions, with two values for each dimension. A discrimination is formed in which one value of one dimension is relevant; following this training, another discrimination is presented with the same stimulus objects, but which requires a shift in response. In the reversal shift situation, the previously irrelevant value of the same dimension as utilized in the initial discrimination is now reinforced, while in the nonreversal shift situation the relevant value belongs to the previously irrelevant dimension. For example, if the two dimensions were size (large and small) and color (black and white), and large had been the relevant value in the initial discrimination, then a reversal shift would involve small becoming relevant in the second discrimination, and a nonreversal shift would involve either black or white becoming relevant.

For a non-mediating S, it is assumed that the nonreversal shift would be easier to learn than the reversal shift because in the former case responding to stimuli in the new discrimination has been reinforced equally often. Thus, response strength to the new stimuli is equal following the initial discrimination. In the reversal shift situation, however, responding to the irrelevant stimulus in the second discrimination has been continually reinforced, while responding to the new relevant stimulus has never been reinforced; extinction to the new irrelevant dimension should take much longer in this second instance.

For a mediating S, however, the situation reverses. In the case of the reversal shift, the mediator is still relevant, and all that must be learned is the alternative overt response. In the non-reversal situation, however, both the mediating response and the overt response must be changed, making this a more difficult task.

T. Kendler (1963) discusses a series of experiments which bear upon the development of verbal mediation with age. First, she reports that children between 3 and 4 years of age found the nonreversal shift easier, while children between the ages of 5 and 7 divide about equally, half finding the nonreversal shift easier, and half finding the reversal shift easier.

In an attempt to further isolate the nature of the developing mediational process, children from five age levels (3, 4, 6, 8, and 10 years of age) were run in a modification of the above procedure (called an "optional shift" procedure) which allowed Ss to select whether they would respond in a reversal or a nonreversal manner. In this situation, the experiment was conducted in three phases. In the first phase, Ss were presented with two pairs of cards, one pair being presented on each trial. One pair consisted of a large black square (LB) and a small white square (SW), while the other pair consisted of a large white square (LW) and a small black square (SB). For the S for whom black was the relevant value in this phase, he was rewarded for selecting the LB card whenever the first pair was presented, and the SB card whenever the second pair was presented. Following this training, only one pair was presented (e.g., LB and SW) and selection of the opposite card from that rewarded in Phase I was reinforced. When S has learned to respond to the opposite card, three possibilities are present: 1) he may be responding to white, in a reversal fashion; 2) he may be responding to small, in a nonreversal fashion; or 3) he may be responding to both white and small. To test this, in Phase III both pairs of cards were again presented in random order. The pair not used in Phase II (e.g., LW and SB) comprised the test pair. Responses to this pair were consistently reinforced, regardless of the card chosen. If

Ss were responding in a reversal fashion, they would now respond to the LW card, while if they were responding in a nonreversal manner they should now respond to the SB card. If they were responding to both white and small, their selection should be inconsistent during this phase.

It was found that the percentage of children selecting the reversal shift mode of responding increased with chronological age, while the percentage of children responding inconsistently decreased with age. However, the percentage of Ss responding in the nonreversal fashion remained relatively constant across age groups. To look further into this somewhat surprising finding, an analysis was made of the children's verbal behavior when asked, following the completion of Phase III, which value was the correct one in Phase II. These verbalizations were grouped into three categories: 1) those that indicated the correct dimension (in terms of their performance in Phase III); 2) those that indicated the incorrect dimension; and 3) those who did not indicate any dimension. On the basis of this analysis, it was found that those Ss who performed in a reversal fashion generally verbalized the correct dimension. Nearly half of the inconsistent Ss furnished no relevant verbalizations. However, approximately a fourth of the nonreversal Ss verbalized the incorrect dimension. On the basis of this finding, it was suggested that in this particular paradigm inconsistent responding indicates little or no verbal mediation, while nonreversal responding indicates a transition stage, in which verbal responses occur, but do not mediate performance; reversal responding indicates the use of verbal mediation. It should be pointed out that the Kendlers had previously determined that even the youngest Ss could name the values and dimensions used in this experiment when explicitly asked to do so.

Two further studies were designed to handle some of the suggestions rising out of Luria's data. In the first experiment, 4-year-olds and 7-year-olds were initially presented with only one pair of cards (e.g., LB and SW) and Ss were instructed to verbalize "black" to describe the correct stimulus. In the second phase of the experiment a reversal shift procedure was conducted, both sets of cards were presented, and for half the Ss size was the relevant dimension and for the other half color was the relevant dimension. Thus, for half the Ss the verbalizations learned in the first phase were relevant, and for half they were competing. A control group was run which received no verbalization instructions. It was found that for the older Ss there was no difference between those who received the relevant verbalization condition and those who received the no verbalization condition, implying that these Ss would furnish their own mediators when not explicitly trained to do so. The irrelevant verbalization condition resulted in an impairment of performance for both groups. For the younger group, however, the relevant verbalization condition resulted in more rapid acquisition of the reversal shift in Phase II. Thus, it appeared that the supplying of the verbalization resulted in some improvement in performance. This did not result in younger Ss receiving relevant verbalization now performing as well as older Ss, however. The interaction between verbalization and age fell just short of significance; such an interaction would have lent support to Luria's findings that with younger children verbal mediation processes drop out even when established if not explicitly maintained throughout the course of the experiment. It could also have been interpreted as support for the verbal mediation hypothesis, discussed below.

T. Kendler (1964) investigated the effects of induced verbalization in the optional shift procedure. Working with kindergarten children, she found facilitation in both initial learning and in later optional shift performance (i.e., more Ss responded in a reversal manner) when Ss were required to state a sentence verbalizing both the correct and the incorrect values of the relevant stimulus on each trial in the initial training.

Reese (1962) attempted to summarize the major findings of Luria and Kendler by proposing the "mediational deficiency hypothesis." He proposed that depending upon Ss' age, the experimental situation, and the concepts involved, there is a stage of development in which verbal responses, while occurring in the situation, do not serve as mediators. In support of this statement, he provided the following evidence: 1) kindergarteners and preschool children, even with instructions to verbalize, do worse than older Ss on a reversal shift. These Ss are assumed to have the mediators, they can use and understand them in other situations, but they do not operate on task performance. 2) In a discrimination situation, instructions that the same stimulus is always rewarded are more effective for older than for younger children. 3) In transposition experiments, frequency or relational responding on "far" tests increases with age, and possession of the concept involved is apparently more effective for older vs. younger children. 4) In acquired equivalence studies, pretraining with verbal responses facilitates older preschoolers' performance more than it does young preschoolers.

Youniss and Furth (1963), two researchers in the area of concept formation in deaf children, attacked Reese's position on several counts. First they suggested that the mediational deficiency hypothesis was based upon ad hoc reasoning; if older Ss do better than younger ones in some task, then the mediational deficiency hypothesis is confirmed. However, they suggest that Ss may differ on many non-linguistic dimensions. Secondly, they accuse Reese of the use of circular reasoning. Reese, in his article, indicates a number of experiments which do not show a differential effect of verbal behavior as a function of age; he then explains these in terms of verbal mediation not being required for task performance. Finally, they suggest that their work with deaf children, who can be regarded as a nonverbal control, indicate that at all ages deaf children respond on a number of tasks supposedly requiring verbal mediation much like their normal controls. They conclude, "...the mediational deficiency hypothesis is an oversimplification of a complex issue, whose solution has been shown to be resistant to simple explanations" (p. 501).

Reese (1963), in answer to the criticism of Youniss and Furth, suggests that the mediational deficiency hypothesis is not intended to be explanatory, but rather descriptive of certain age differences. "It is a statement of inferences about mediation based on the finding in certain experimental situations that older children perform as would be predicted if mediation occurred and younger children tend to perform as would be predicted if mediation did not occur" (p. 503).

Flavell, Beach, and Chinsky (1966) suggested that there were two ways of explaining the deficiency of verbally mediated performance in young children: 1) the mediational deficiency hypothesis, i.e., where the verbal response occurs in the situation but does not mediate the appropriate response, and 2) the production deficiency hypothesis, i.e., the verbal response tends not to occur in the situation even though it is in the child's repertoire. These investigators then attempted to lend some methodological sophistication to this area. They suggested four criteria which should be met in order to test the mediational deficiency hypothesis: 1) Elicitation—the task must be such that older Ss would naturally use a verbal mediational approach; 2) Mediation—E must be able to distinguish between mediated and nonmediated overt responses; 3) Production—E must establish that S actually produced potential mediators; and 4) Competence—different age groups must be shown equally capable of interpreting the mediating words. A test of the production deficiency hypothesis requires that only the first three criteria be met.

On the basis of this analysis, Flavell, et al., constructed a task in which E pointed in succession to 3 of 7 pictures of common objects. Either immediately afterward or 15 seconds later S had to point to the same 3 objects in the same sequence, the pictures now arranged in a different random order. A picture-naming task was included to assess labelling ability, and a point-and-name task, in which E pointed to each picture in sequence, requiring S to overtly name the picture, and then 15 seconds later requiring S to point to the same pictures now in scrambled order and again overtly name each picture as he pointed to it. Three groups of Ss were run: kindergarteners, second graders, and fifth graders. These investigators hypothesized that 1) second grade Ss would produce more verbal rehearsal than would kindergarten Ss under the 15-second delay condition; 2) fifth grade Ss would produce less observable verbal rehearsal than kindergarten Ss, due to greater internalization of covert speech; and 3) induced labelling would affect recall and rehearsal behaviors. In order to observe mediating speech responses as carefully as possible, all Ss wore a space helmet to increase the probability of overt or semi-overt verbal responses, and they were carefully observed by one of the Es who had been given special training in lip-reading prior to the experiment.

The results indicated that there was a significant increase in both recall and verbalization with grade level, and that there was a significant increase in performance under the enforced labelling condition for all Ss (the hypothesized internalization of mediational speech was not observed in the fifth grade Ss). All Ss, regardless of grade level, did equally well in the picture-naming task. No differential effects of verbalization dependent on age were found, however.

IV
DISCUSSION

On the basis of this review, it is suggested that the theorist-researchers discussed are dealing with basically the same phenomenon in their theoretical and experimental endeavors. This conclusion seems justified by the similarity of their findings with respect to verbal mediation as a function of age. Specifically, two findings recur throughout the paper. First, verbal behavior is correlated with the development of various types of problem-solving behavior. This verbal behavior is originally overt but tends to become internalized, permitting the child to continue to solve problems that would not be possible without some sort of mediating mechanism. Second, there appears to exist a period when, although the appropriate verbal responses are in the child's repertoire, they do not serve a mediating function.

Several related generalizations may be drawn from the material presented concerning the development of the verbal mediation process. The first is that verbal mediation occurs quite late in the speech development of the child. The second is that the development of the mediational process takes place across a relatively long period of time. Luria places the beginnings of the operation of the Second Signal System at between 5 and 9 years of age, and true verbal mediation is not regarded as occurring until after the age of 9. Vygotsky is unclear as to the age when verbal mediation first occurs, but he indicates that Piaget's data suggest that egocentric speech does not disappear until about the age of 7 or 8; thus inner speech in his model could not be completely developed until this time. Bruner's data indicate that symbolic representation does not begin until some time around 4 years of age and is not completely free from interference from iconic modes of representation at 7 years. Kendler also places the beginning of the transition to verbal mediation at about 5, and at least one study indicates that some children have not yet completed this transition by the age of 10.

The third major generalization is that children during this transition stage are not capable of a number of forms of behavior dependent upon self-control through verbal mechanisms. Because this transition period overlaps with the early school years of the child, this becomes an educational problem. It would seem that the researcher in education can adopt two kinds of strategy at this point: 1) he can revise the curriculum so that it is congruent with a child's ability at a given time, or 2) he can suggest ways to change the abilities themselves.

The data and theory presented herein suggest several ways the first strategy can be carried out. Bruner (1966b) has suggested that the mode of representation be changed. He says that any body of knowledge or problem within that body of knowledge can be represented enactively, iconically, or symbolically. Thus, Bruner's solution to the problem is to arrange the learning situation so that the material to be learned can be represented in an earlier developed system. The Kendlers, and particularly Luria, would suggest that students be given specific verbal mediators to handle various educational problem tasks. Luria might even suggest that students should be encouraged to use overt mediators, particularly in more complex situations.

With the exception of Bruner, the investigators discussed in this paper have been silent with respect to the second strategy. This seems somewhat surprising in that both the Kendlers and Luria operate within a traditional learning theory. In fact, H. Kendler indicates that he maintains an S-R position because of this background of learning principles upon which he can draw. A systematic investigation of the development of mediation processes in terms of the learning principles involved would seem to be a fruitful endeavor at this time. An analysis must initially be made of the source of learning deficit. The question of whether mediational deficiency or production deficiency

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is responsible for the failure of mediation to take place is a meaningful question, since the procedures that would be applied in an attempt to correct the deficiency would be different in the two cases.

As a concluding remark, a few words should be said about the nature of the verbal mediator. At first glimpse, this would appear to be one of the major areas of difference. Luria, Vygotsky, and Bruner all put great stress upon the conception of inner speech or thought processes involving the semantic component of verbal behavior rather than the phonemic component. Kendler, however, does not represent the opposite view; rather, he is very careful to avoid the issue, suggesting that at least in terms of the phenomena in which he is interested, the exact nature of the mediating mechanism makes no difference. Certainly there are several theorists in the S-R tradition who are explicit in their consideration of the phonemic elements of speech playing an important role in the verbal mediation process, e.g., Osgood (1953), Mowrer (1960), and Staats and Staats (1963). There are, of course, theorists such as Bousfield who lean more toward the Watsonian view, but as H. Kendler (1964) has pointed out, controversy between these two positions can but result in important advances in mediation theory and conceptual behavior. Kendler has suggested that whether verbal mediation processes are considered as r-s mechanisms or as cognitions, principles, strategies, etc., "...seems to reflect personal preference for models and language systems adopted to represent behavior instead of fundamental theoretical assumptions" (p. 229). Certainly the view that verbal behavior, particularly the implicit mediating form of verbal behavior, has different properties and functions from other forms of behavior as particularly held by the Russian school and by Bruner and supported by the data presented earlier, increases greatly the credence of such a distinction.

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